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EXAMINER

BARTON, JEFFREY THOMAS

ART UNIT	PAPER NUMBER
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1753

DATE MAILED: 02/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/089,933

Applicant(s)

REIHS ET AL.

Examiner

Jeffrey T. Barton

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 March 2003.
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14-36 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 14-36 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 20021118, 20030311.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____

DETAILED ACTION

Priority

1. Applicant cannot rely upon the foreign priority papers to overcome various rejections presented here, because a translation of said papers has not been made of record in accordance with 37 CFR 1.55. See MPEP § 201.15.

Claim Objections

2. Claims 16, 25, 27, and 36 are objected to because of the following informalities: the terms "constant screen" and "screen of electrodes" are unclear. Is a limitation to an array of electrodes, such as illustrated in Figure 1 (Electrodes 3), intended? The claims are herein treated as requiring an array of electrodes. Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 17 and 29 are rejected under 35 U.S.C. 102(b) as being anticipated by Washizu.

Regarding claim 17, Washizu discloses a device for dosing liquid drops (e.g. Figure 1), comprising a support (Hydrophobic Surface), an electrically chargeable manipulator (Array of electrodes beneath surface), and a means for generating an inhomogeneous electric field (V_1 - V_6).

Regarding claim 29, Washizu discloses dosing drops with volume of about 1 microliter. (Figure 2) Dosing is disclosed in Figure 5 - reagents are dosed into the central path from the upstream side paths.

5. Claims 17 and 29 are rejected under 35 U.S.C. 102(e) as being anticipated by Becker et al.

Regarding claim 17, Becker et al disclose a device for dosing liquid drops (e.g. Figure 7), comprising a support (Surface 12), an electrically chargeable manipulator (Array of electrodes 43), and a means for generating an inhomogeneous electric field (Signal generator 82).

Regarding claim 29, Becker et al disclose dosing drops with volume between 1 picoliter and 1 microliter. (Column 9, lines 59-63 - a spherical droplet with 100 micrometer diameter has a volume of about 500 picoliters) Dosing is disclosed at Column 12, lines 42-60.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. In this action the term "ultraphobic surface(s)" is considered to be limited to the definition given on page 3, lines 8-10 of the specification.

10. Claims 14-16, 18, 24-28, 30, and 34-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Becker et al in view of either Okumura et al or Onda et al.

Regarding claims 14 and 24, Becker et al disclose a substrate and method of moving liquid droplets thereon, wherein the substrate has several electrodes (Figure 12, electrodes 43) and varying voltages can be applied to the electrodes, resulting in an inhomogeneous field that causes droplet motion. (Column 7, line 42 - Column 8, line 5; Column 8, line 52 - Column 9, line 57) Becker et al disclose the desirability of the substrate having a hydrophobic surface, but require no coating in particular. (Column 11, line 62 - Column 12, line 22)

Regarding claims 15, 16, and 34-36, Becker et al disclose several electrodes disposed in a regular array (constant screen) in the substrate, substantially aligned with the surface of the substrate. (Figures 5, 11, 12)

Regarding claims 25-27, Becker et al disclose moving droplets in any direction by applying varied voltages to the electrodes, including combining droplets. (Column 8, lines 3-5; Column 8, line 52 - Column 9, line 57; Figure 12; Column 22, lines 36-60)

Regarding claims 28 and 30, Becker et al disclose dosing (Column 12, lines 42-60) and moving (Figure 12; Column 22, lines 36-60) drops within this volume range. (Column 9, lines 59-63 - a droplet with 100 micrometer diameter meets the volume limitation)

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Becker et al do not explicitly disclose their device having an "ultraphobic" surface.

Okumura et al disclose a surface coating that provides a contact angle with water of about 150°.

Onda et al disclose a surface coating that provides a water contact angle as large as 174°.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device and method of Becker et al by using an "ultraphobic" surface with water contact angles of 150° or more, as taught by Okumura et al or Onda et al, because given the disclosed desirability of hydrophobic surfaces, it would be within the abilities of a skilled artisan to choose a suitable coating from among hydrophobic coatings known in the prior art. Furthermore, in the case of aqueous fluid manipulation, higher degrees of hydrophobicity would allow higher-speed movement of the drops due to reduced friction between the droplet and the surface, enabling faster analyses and reactions. Becker suggests the desirability of increased droplet velocity at Column 9, lines 58-67.

Regarding claim 18, the surfaces of Okumura et al and (particularly) Onda et al are highly rough, which is part of the reason for their high hydrophobicity. Absent a showing to the contrary, the roughness of these surfaces is considered by the examiner to meet the limitations of this claim.

11. Claims 14-16, 18, 22, 24-28, 30, and 34-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Becker et al in view of Ogawa et al.

The disclosure of Becker et al is as described above in paragraph 10.

Becker et al do not explicitly disclose their device having an "ultraphobic" surface.

Ogawa et al disclose an ultraphobic surface with contact angle up to 171° (Abstract) that is applied to a sandblasted surface. Ogawa et al discuss that this is a known method of roughening surfaces to achieve greater hydrophobicity. (Column 7, lines 42-53)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device and method of Becker et al by using an "ultraphobic" surface with water contact angles of 170° or more, as taught by Ogawa et al, because given the disclosed desirability of hydrophobic surfaces, it would be within the abilities of a skilled artisan to choose a suitable coating from among hydrophobic coatings known in the prior art. Furthermore, in the case of aqueous fluid manipulation, higher degrees of hydrophobicity would allow higher-speed movement of the drops due to reduced friction between the droplet and the surface, enabling faster analyses and reactions. Becker suggests the desirability of increased droplet velocity at Column 9, lines 58-67.

Regarding claim 18, the surfaces of Ogawa et al are highly rough, which is part of the reason for their high hydrophobicity. Absent a showing to the contrary, the roughness of these surfaces is considered by the examiner to meet the limitations of this claim.

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12. Claims 14-16, 18, 19, 24-28, 30, and 34-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Becker et al in view of Clark et al.

The disclosure of Becker et al is as given above in paragraph 10.

Becker et al do not explicitly disclose their device having an "ultraphobic" surface.

Clark et al disclose a surface coating, optionally formed from structured aluminum, that provides a contact angle with water of up to about 180°. (Column 4, line 62 - Column 5, line 15; Column 7, lines 26-31; Example 2; Table 2)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device and method of Becker et al by using an "ultraphobic" surface with water contact angles of up to 180°, as taught by Clark et al, because given the disclosed desirability of hydrophobic surfaces, it would be within the abilities of a skilled artisan to choose a suitable coating from among hydrophobic coatings known in the prior art. Furthermore, in the case of aqueous fluid manipulation, higher degrees of hydrophobicity would allow higher-speed movement of the drops due to reduced friction between the droplet and the surface, enabling faster analyses and reactions. Becker suggests the desirability of increased droplet velocity at Column 9, lines 58-67.

Regarding claim 18, the surface of the coating of Clark et al is highly rough, which is part of the reason for its high hydrophobicity. Absent a showing to the contrary, the roughness of these surfaces is considered by the examiner to meet the limitations of this claim.

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13. Claims 14-16, 18, 24-28, 30, and 34-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Washizu in view of either Okumura et al or Onda et al.

Regarding claims 14 and 24, Washizu discloses a substrate and method of moving liquid droplets thereon, wherein the substrate has several electrodes (e.g. Figure 1) and varying voltages can be applied to the electrodes, resulting in an inhomogeneous field that causes droplet motion. (Figures 1 and 3) Washizu discloses the desirability of the substrate having a hydrophobic surface, and discusses highly hydrophobic surfaces such as those of Onda et al. (Page 734, 3rd-5th full paragraphs)

Regarding claims 15, 16, and 34-36, Washizu discloses several electrodes disposed in a regular array (constant screen) in the substrate, substantially aligned with the surface of the substrate. (Figures 1, 3, and 5)

Regarding claims 25-27, Washizu discloses moving droplets in varied directions by applying different voltages to the electrodes, including combining droplets. (Figure 5)

Regarding claims 28 and 30, Washizu discloses dosing and moving drops within this volume range. (Figure 2 - 1 microliter drop discussed)

Washizu does not explicitly disclose their device having an "ultraphobic" surface.

Okumura et al disclose a surface coating that provides a contact angle with water of about 150°.

Onda et al disclose a surface coating that provides a water contact angle as large as 174°.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device and method of Washizu by using an

“ultraphobic” surface with water contact angles of 150° or more, as taught by Okumura et al or Onda et al, because given the disclosed desirability of hydrophobic surfaces, it would be within the abilities of a skilled artisan to choose a suitable coating from among hydrophobic coatings known in the prior art, especially one specifically discussed by Washizu. (Onda et al) Furthermore, in the case of aqueous fluid manipulation, higher degrees of hydrophobicity would lower the actuation force needed to cause motion of the drops due to reduced friction between the droplet and the surface. Washizu teaches this way of reducing actuation force. (Paragraph bridging pages 733 and 734, criterion 1)

Regarding claim 18, the surfaces of Okumura et al and (particularly) Onda et al are highly rough, which is part of the reason for their high hydrophobicity. Absent a showing to the contrary, the roughness of these surfaces is considered by the examiner to meet the limitations of this claim.

14. Claims 14-16, 18, 22, 24-28, 30, and 34-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Washizu in view of Ogawa et al.

The disclosure of Washizu is as described above in paragraph 13.

Washizu does not explicitly disclose a device having an “ultraphobic” surface.

Ogawa et al disclose an ultraphobic surface with contact angle up to 171° (Abstract) that is applied to a sandblasted surface. Ogawa et al discuss that this is a known method of roughening surfaces to achieve greater hydrophobicity. (Column 7, lines 42-53)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device and method of Washizu by using an "ultraphobic" surface with water contact angles of 170° or more, as taught by Ogawa et al, because given the disclosed desirability of hydrophobic surfaces, it would be within the abilities of a skilled artisan to choose a suitable coating from among hydrophobic coatings known in the prior art. Furthermore, in the case of aqueous fluid manipulation, higher degrees of hydrophobicity would lower the actuation force needed to cause motion of the drops due to reduced friction between the droplet and the surface. Washizu teaches this way of reducing actuation force. (Paragraph bridging pages 733 and 734, criterion 1)

Regarding claim 18, the surfaces of Ogawa et al are highly rough, which is part of the reason for their high hydrophobicity. Absent a showing to the contrary, the roughness of these surfaces is considered by the examiner to meet the limitations of this claim.

15. Claims 14-16, 18, 19, 24-28, 30, and 34-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Washizu in view of Clark et al.

The disclosure of Washizu is as described above in paragraph 13.

Washizu does not explicitly disclose their device having an "ultraphobic" surface.

Clark et al disclose a surface coating, optionally formed from structured aluminum, that provides a contact angle with water of up to about 180°. (Column 4, line 62 - Column 5, line 15; Column 7, lines 26-31; Example 2; Table 2)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device and method of Washizu by using an "ultraphobic" surface with water contact angles approaching 180°, as taught by Clark et al, because given the disclosed desirability of hydrophobic surfaces, it would be within the abilities of a skilled artisan to choose a suitable coating from among hydrophobic coatings known in the prior art. Furthermore, in the case of aqueous fluid manipulation, higher degrees of hydrophobicity would lower the actuation force needed to cause motion of the drops due to reduced friction between the droplet and the surface. Washizu teaches this way of reducing actuation force. (Paragraph bridging pages 733 and 734, criterion 1)

Regarding claim 18, the surface of the coating of Clark et al is highly rough, which is part of the reason for its high hydrophobicity. Absent a showing to the contrary, the roughness of these surfaces is considered by the examiner to meet the limitations of this claim.

16. Claims 14-16, 18, 19, 24-28, 30, and 34-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Becker et al or Washizu in view of Reihs et al. (WO 00/39369)

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The reasoning for this rejection parallels those given above for other prior-art ultraphobic coatings. Reihs et al disclose an ultraphobic coating according to the limitations of the claim.

17. Claims 14-16, 18, 20, 24-28, 30, and 34-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Becker et al or Washizu in view of Reihs et al. (WO 00/39368)

The reasoning for this rejection parallels those given above for other prior-art ultraphobic coatings. Reihs et al disclose an ultraphobic coating according to the limitations of the claim.

18. Claims 14-16, 18, 21, 24-28, 30, and 34-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Becker et al or Washizu in view of Reihs et al. (DE 198 60 139)

The reasoning for this rejection parallels those given above for other prior-art ultraphobic coatings. Reihs et al disclose an ultraphobic coating according to the limitations of the claim.

19. Claims 14-16, 18, 22, 24-28, 30, and 34-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Becker et al or Washizu in view of Reihs et al. (WO 00/38845)

The reasoning for this rejection parallels those given above for other prior-art ultraphobic coatings. Reihls et al disclose an ultraphobic coating according to the limitations of the claim.

20. Claims 14-16, 18, 23-28, 30, and 34-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over either Becker et al or Washizu in view of Reihls et al. (DE 198 60 135)

The reasoning for this rejection parallels those given above for other prior-art ultraphobic coatings. Reihls et al disclose an ultraphobic coating according to the limitations of the claim.

21. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Becker et al in view of Wilding et al.

The disclosure of Becker et al is as given above in paragraph 10. The system of Becker et al is disclosed as a general reaction system, without mention of any specific type of reaction to be carried out.

Wilding et al describe various biological reactions and analyses suitable for small-scale processing in a microfluidic device in their Background and Summary sections, including the processes specified in these claims.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the system of Becker et al to carry out the processes described by Wilding et al, because one having ordinary skill in the art would be able to

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choose a reaction to be performed. Becker et al disclose their device as a reactor (e.g. Column 22, lines 36-49), and did not limit the reaction to any specific type, leaving the decision on the specific application up to a skilled artisan.

22. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Washizu in view of Wilding et al.

The disclosure of Washizu is as given above in paragraph 13.

The system of Washizu is disclosed as a general reaction system, without mention of any specific type of reaction to be carried out, although biochemical reactions are suggested. (e.g. Page 732, final paragraph of the Introduction)

Wilding et al describe various biological reactions and analyses suitable for small-scale processing in a microfluidic device in their Background and Summary sections, including the processes specified in these claims.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the system of Washizu to carry out the processes described by Wilding et al, because one having ordinary skill in the art would be able to choose a reaction to be performed. Washizu discloses his device as a reactor (e.g. Title), and did not limit the reaction to any specific type, leaving the decision on the specific application up to a skilled artisan.

23. Claims 31 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Becker et al and any one of the Reihis references, Okumura et al, Onda et al,

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Ogawa et al, or Clark et al, as applied to claims 14 and 24 above, and further in view of Wilding et al.

The reasoning for this rejection parallels that given above in paragraph 21.

24. Claims 31 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Washizu and any one of the Reihis references, Okumura et al, Onda et al, Ogawa et al, or Clark et al, as applied to claims 14 and 24 above, and further in view of Wilding et al.

The reasoning for this rejection parallels that given above in paragraph 22.

Conclusion

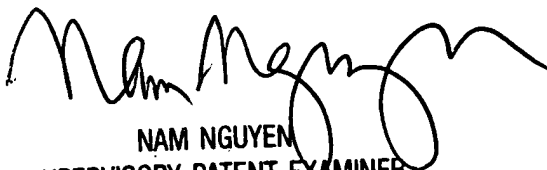
25. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Church and Anthes et al disclose hydrophobic coatings similar to those claimed above, but without meeting all limitations.

26. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Jeffrey Barton, whose telephone number is (571) 272-1307. The examiner can normally be reached Monday-Friday from 8:30 am – 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen, can be reached at (571) 272-1342. The fax number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at (866) 217-9197 (toll-free).

JTB
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